IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Rigney et al.	:	
Application No.: 10/086,148	:	Group Art Unit: 3726
Filed: July 10, 2000	:	Examiner: Rosenbaum, Irene.

For: METHOD FOR REPLACING A DAMAGED TBC CERAMIC LAYER

APPEAL BRIEF

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please charge the Appeal Fee of $330, and any other charges necessary for consideration of this appeal to McNees, Wallace & Nurick Deposit Account No. 50-1059. In accordance with 37 C.F.R. 1.192, this brief is being filed in triplicate. A petition for a two-month extension of time is included with this appeal brief.

This Appeal Brief is filed in response to the second rejection of the Examiner dated October 6, 2003, pursuant to 37 CFR §1.191.

Certificate of Mailing (37 CFR §1.8 (a))

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1. *REAL PARTY OF INTEREST*

The real party of interest in this pending application is General Electric Company, Assignee of inventors' interest, which assignment has been duly recorded in the United States Patent and Trademark Office on October 22, 2001 at Reel/Frame No. 012504/0037. The United States Government has rights in this invention pursuant to Government Contract No. N00019-96-C-0080.

2. *RELATED APPEALS OR INTERFERENCES*

There are no other appeals or interferences known to Appellants' legal representative or Assignee which will directly affect or be directly affected by or have a bearing on the Board's Decision in this pending appeal, nor are there any directly related co-pending applications known to Appellants' legal representative.

3. *STATUS OF CLAIMS*

After having been initially rejected in an Office Action dated March 24, 2003, claims 1-27 were responded to on June 27, 2003. The claims were allowed on August 1, 2003. The allowance of claims 1-27 was withdrawn on October 6, 2003, and claims 1-27 were rejected for a second time. Claims 1-27 are currently pending in the application. Claims 2-26 are appealed.

4. *STATUS OF AMENDMENTS*

Appellants have submitted no response to the October 6, 2003 Office Action, rejecting claims 1-27 for a second time. Instead, Appellants have exercised their rights under 37 C.F.R. 1.191, electing, after the allowance was withdrawn, to appeal the twice rejected claims.

5. *SUMMARY OF INVENTION*

The present invention is directed to a process for to accomplish a local repair of a turbine component that has experienced local damage that will affect its life without having to strip the entire coating from the component, as is the current practice. The process includes the steps of

first cleaning a localized region of the component where the thermal barrier coating has spalled from the surface. The thermal barrier coating system includes a bond coat applied over a substrate surface. A ceramic top coating, such as a yttrium-stabilized zirconia, is applied over the bond coat. The bond coat improves the adhesion of the ceramic top coat to the component. The ceramic top coat typically peels or spalls away from the underlying surfaces, leaving an exposed surface. The exposed surface is then textured so as to provide an array of spaced grooves of predetermined groove spacing and predetermined groove geometry, including a predetermined wall angle with the exposed surface. Replacement thermal barrier coating, typically a ceramic, is then applied over substantially only the grooved area. The grooving of the surface is performed by using a carefully controlled high energy beam to apply the spaced grooves having the predetermined spacing and geometry to the exposed surface. In one embodiment, the spaced grooves are carefully applied to the exposed substrate surface and a replacement bond coat is applied to the exposed substrate surface without filling in the grooves. In another embodiment, the spaced grooves are carefully applied to the bond coat overlying the substrate, without exposing the substrate, and the ceramic coating is applied over the grooved bond coat. In the most preferred embodiment, a linear array of substantially equally spaced grooves intersect at an angle of between about 15° to about 90°, the spacing between the grooves being between about 0.001-0.005 inches, the grooves being no deeper than the thickness of the bond coat and formed by a high energy beam angled between 0°-75° to the surface of the bond coat.

6. ***ISSUES***

A. Whether Nagaraj et al., U.S. Patent No. 5,723,078 anticipates claims 2, 4, 8, 9 and 21-26 as required by MPEP §2131.

B. Whether appealed Claims 2-26 are properly rejected under 35 U.S.C. §103(a) over Nagaraj et al. (U.S. Patent No.5,723,078) in view of Skelly et al. (U.S. Patent No. 5,419,971) as there is no motivation to combine the references.

C. Whether the prior art when considered as a whole include teachings that conflict to render the combination inoperable.

D. Whether the combination of Nagaraj et al and Skelly et al. is based on hindsight reasoning by the Examiner.

7. *GROUPING OF CLAIMS*

Dependent claims 2-23 constitute a first grouping of claims directed to an array of spaced grooves formed by a high energy beam, the array of spaced grooves having a predetermined groove spacing, predetermined groove geometry and predetermined wall angel with the exposed surface. Dependent claim 2 adds these additional limitations to claim 1, and its patentability should be considered in light of these additional limitations. Dependent claims 3-7 stand or fall with claim 2 and identify specific methods and parameters for performing the steps of claim 2. Dependent claims 8-9 include all of the elements of claim 1 and additional limitations for accomplishing the methods of claim 1. Claims 8-9, incorporating all of the elements of claim 1, stand or fall together. Dependent claims 10-11 add specific geometric limitations to the array of grooves of claim 1 and their patentability should be considered in light of these specific limitations. Dependent claim 12 adds two sets of intersecting grooves as a limitation to the elements of claim 1 and its patentability should be considered in light of these specific limitations. Dependent claim 13 adds a groove depth that does not exceed the thickness of deposited ceramic material as a further limitation to the elements of claim 1, and its patentability should be considered in light of this specific limitation. Claim 14 adds the required specific angles of incidence of the high energy beam to produce specific wall angles to further limit the elements of claim 2, and its patentability should be considered in light of this specific limitation. Dependent claims 15-20, which add additional limitations directed to an exposed substrate surface, stand or fall together, and their patentability should be considered in light of these additional limitations. Dependent claims 21-23 stand or fall together and add limitations to the elements of claim 1, directed to cleaning and texturing only a remaining bond coat without exposing the substrate surface.

Independent claim 24 and dependent claims 25-26 constitute a second grouping of claims directed to specific configurations of intersecting grooves and stand or fall together.

8. *ARGUMENTS*

A. Whether Nagaraj et al., U.S. Patent No. 5,723,078 anticipates claims 2, 4, 8, 9 and 21-26 as required by MPEP §2131.

In the Office Action dated October 6, 2003, claims 1, 2, 4, 8, 9, 21-23 and 27 stand rejected under 35 U.S.C. §102(b) as anticipated by Nagaraj et al. (U.S. Patent No. 5,723,078). The Examiner states:

> Claims 1, 2, 4, 8, 9, 21-23 and 27 are rejected under 35 U.S.C. §102(b) as anticipated by Nagaraj et al. '078. This patent teaches all of the claim limitations of claim 1 except it does not explicitly teach that the groove spacing, geometry and wall angle with the surface is 'predetermined' as set out in claim 1.

To anticipate the claims, the '078 patent must teach each and every element of the claims. MPEP §2131 states:

> **TO ANTICIPATE A CLAIM, THE REFERENCE MUST TEACH EVERY ELEMENT OF THE CLAIM**
>
> "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an ipsissimis verbis test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990). Note that, in some circumstances, it is permissible to use multiple references in a 35 U.S.C. §102 rejection. See MPEP Section 2131.01.

The Examiner clearly acknowledges in the rejection that an explicit teaching of the claim, specifically predetermined groove spacing, geometry and wall angle, which are also a claim limitation, is missing from the '078 reference. Under MPEP §2131, the '078 reference cannot anticipate the claims. Claim 2 adds the limitation that the array of grooves having the

predetermined features be formed by a high energy beam. The example provided by the Examiner to form the array of groves is a mechanical cutting tool. The Examiner argues

> For example, the patent teaches at column 5, lines 1-3 that a mechanical indentor or cutting tool can be dragged over the surface to form an array of grooves. Clearly the artisan, by the choice of the cutting tool and how he decides to operate it, inherently 'predetermines' the groove spacing, geometry and wall angle e.g. are the groove walls in the shape of a V so the walls are at an angle or do the grooves have straight walls at 90 degree angle to the surface, in the array of grooves.

While Appellants do not agree with the Examiner's contention on inherency, the point is moot, as claim 1 is not appealed, and claim 2 requires a high energy beam. A mechanical cutting tool is not a high energy beam.

The Examiner further states:

> Likewise column 5, lines 14-16 teaches that one may use a laser to form a 'groove pattern'. It is inherent that the artisan would have predetermined (that is, decided in advance) the groove pattern before s/he operates the laser to make the 'groove pattern.'

Appellants assert that the Examiner has assumed that the groove pattern is 'predetermined'. Appellants assert that the '078 reference provides no teaching as to 'a predetermined pattern'. Appellants note that the Examiner could just as readily have assumed an irregular groove pattern, as the very next sentence, column 5, lines 17-19 notes that grit blasting is capable of producing the desirable combination of surface features equivalent to that produced by laser techniques. The Examiner cannot seriously maintain that the random texturing produced by grit blasting provides the predetermined groove pattern, including angles, spacing and geometry claimed by Appellants. And if the surface produced by a laser is equivalent to the surface produced by grit blasting in the '078 reference, as indicated by the '078 reference, then the teaching of a predetermined groove pattern, including angles, spacing and geometry as claimed by Appellants in claim 2, is clearly not present in the '078 reference, which therefore cannot be anticipatory.

B. Whether appealed Claims 2-26 are properly rejected under 35 U.S.C. §103(a) over Nagaraj et al. (U.S. Patent No. 5,723,078) in view of Skelly et al. (U.S. Patent No. 5,419,971) as there is no motivation to combine the references.

Claims 2-26 are rejected under 35 U.S.C. §103(a) as unpatentable over Nagaraj et al. ('078) in view of Skelly et al. ('971).

The Examiner states:

> Nakaraj et al. '078 teaches localized repair of the turbine blade where the thermal barrier ceramic coating has been damaged, by using a mechanical tool or laser to cut an array of grooves or a groove pattern into the bond layer to improve adhesion of the ceramic coating that will be applied to repair the localized damage. Skelly et al. teaches that upon initial application of the ceramic thermal barrier coating to a bond layer on a component such as a turbine blade (column 4, line 56), it is important to use a predetermined groove pattern to obtain 'crack impeding geometries (see abstract and column 3, lines 20-34, column 4, lines 11-13). The preferred method is to use a laser (see column 3, lines 64+). Thus, it would have been prima facie obvious when doing the localized repair of Nakaraj et al. '078 to have used a predetermined groove spacing, geometry, wall angle, as such is taught in Skelly et al. to be important in providing a turbine blade ceramic thermal barrier coating layer onto a grooved bond layer so that the ceramic layer will not crack in operation. One would be motivated by the reasonable expectation of having a superior repair with use of a groove patter as taught by Skelly et al. to be advantageous for applying the ceramic layer onto the bond coat layer to prevent/delay crack propagation through the ceramic layer. Note Skelly et al. teaches a groove spacing of 5 mils at column 9, lines 20-22, with a wall angle between 15 and 90 degrees (see figures 2,4,5- appears to be straight wall grooves in figures 2,4 V shaped grooves in figure 5), the grooves are not thicker than the bond coat 34 of figure 2 etc. – compare to groove spacing etc. set out in present claims 10-14, 24. Note it appears inherent, that one must operate the laser beam at an angle of0 to 75 degrees as recited in claims 14 and 24, in order to obtain the wall angle of 15 to 90 degrees which is suggested by Skelly et al., or alternatively, it would have been prima facie obvious optimization of a known result effective operating parameter to choose an appropriate incidence angle for the laser beam machining of the grooves. Likewise, with respect to claims 6 and 7, it appears that optimizing the known result effective parameters of power level, speed of laser cutting, etc, especially since these are being used in the same context of making grooves with a laser as taught by each reference, would have been prima facie obvious, especially in the absence of criticality or unexpected results from the use of these parameters. With respect to claim 5, Skelly et al. teaches the use of an excimer laser (column 3, line 67).

Appellants respectfully traverse this rejection. Nagaraj et al. ('078), as understood, is discussed above and is directed to a method for repairing the thermal barrier coatings on articles that have been damaged by use in the hostile environment in which the ceramic top coating of the thermal barrier coating system has spalled. Skelly et al. ('971), as understood, is directed to an advanced thermal barrier system applied to the surface of an article that is exposed to a hostile environment to extend the life of the thermal barrier system by preventing the onset of spalling. Both of these inventions are directed at articles used in the hot section of aircraft engines. Skelly et al., in the terminology of those skilled in the art, is directed at "new-make" articles. As such, the system of Skelly et al. is applied to new articles such as turbine blades, and it is applied to the entire surface region that is to be coated with a protective ceramic top coat, and its acknowledged purpose is to extend the life of the new make article. Nagaraj et al. is directed to a locally damaged article that has been removed from service so that it can be repaired and returned to service.

Appellants submit that MPEP §2143 sets forth the basic requirements for establishing a prima facie case of obviousness. MPEP §2143.01 states:

> "There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." *In re Rouffet,* 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a *prima facie* case of obvious was held improper.). The level of skill in the art cannot be relied upon to provide the suggestion to combine references. *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999).

Here, Appellants' invention is directed to a method for locally repairing a damaged thermal barrier component from which the ceramic topcoat has been removed, or from which both the ceramic top coat and bond coat have been removed. The Examiner seeks to utilize Nagaraj et al. ('078) directed to a localized repair of a damaged thermal barrier component. However, this reference is deficient in the elements set forth in Apellants' claims, as discussed above. The Examiner, to overcome these deficiencies, provides Skelly et al. ('971) directed to an enhanced thermal barrier coating system, which is applied to a new blade. Appellants respectfully submit that one skilled in the art of thermal barrier coating systems would not look

to apply the processing techniques for "new make" turbine components taught by Skelly et al. ('971) to repair the localized repairs required by Nagaraj et al. ('078) in order to arrive at Appellants invention. While Skelly et al. ('971) recognizes the common mechanism for failure of thermal barrier coating systems (see '971 at col. 2, lines 3-8), Skelly et al. is directed to extend the life of new make components by delaying the onset or avoiding this failure mechanism (see '971 at col. 2, line 28-35). The invention of Skelly et al. is applied to the entire surface, which will accommodate the thermal barrier system (see '971 at col. 2, lines 50-59) using preprogrammed numerically- controlled or computer-controlled programs (see'971 at col. 3, lines 20-23 and col. 6, lines 66+). These machines translate the substrate with respect to the machine to produce the pattern. Although the art is related, Appellants submit that one skilled in the art, seeking a solution to the problem of localized repair of thermal barrier topcoats due to spallation or loss of the ceramic topcoat, or ceramic topcoat and underlying bond coat, would not look to the processes and procedures utilized to manufacture new make articles. The processes and procedures for new-make articles as described in Skelly et al. are designed to prevent spalling, whereas Nagaraj et al. is directed to providing a localized repair to a component, which has already experienced spalling. The processes for new make articles in Skelly et al. are highly automated to accommodate a large number of identical parts. The repairs required by Nagaraj et al. are highly localized, "job-type" repairs, not amenable for adoption to the automated techniques of Skelly et al.

The standard for determining prima facie obviousness was stated in *In re Lintner,* 173 USPQ 560 (CCPA 1972) where the Court of Customs and Patent Appeals, predecessor to the Federal Circuit, stated: "In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination or other modification."

In *In re Dance,* 160 F.3d. 1399, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998), the Federal Circuit stated that, "to establish a *prima facie* case of obviousness based on a combination of the content of various references, there must be some teaching, suggestion or motivation in the prior art to make the specific combination that was made by the applicant." Further, "The teachings of the references, their relatedness to the field of the applicant's endeavor, and the knowledge of

persons of ordinary skill in the field of the invention, are all relevant considerations." Finally, the Court stated that, "the test of whether it would have been obvious to select specific teachings and combine them as did the applicant must still be met by identification of some suggestion, teaching or motivation in the prior art, arising from what the prior art would have taught a person of ordinary skill in the field of the invention."

For these reasons, Appellants submit that one skilled in the art, faced with localized repair of thermal barrier coatings such as set forth in Nagaraj et al. is a different problem than that solved by Skelly et al. and thus would not look to new-make articles such as set forth in Skelly et al., which are designed to prevent spalling, for a solution to apply ceramic top coats to localized spalled regions of components such as turbine blades. Even though both are related to thermal barrier coating systems, they solve different problems. Appellants respectfully submit that because the problems solved by Nagaraj et al. and Skelly et al. are sufficiently different, there is no motivation or suggestion for one skilled in the art to combine the solution of Skelly et al. for preventing spallation of new-make parts with Nagaraj et al. for improving adhesion of ceramic top coat to repair components removed from service that have experience localized damage to the top coats.

C. Whether the prior art when considered as a whole include teachings that conflict to render the combination inoperable.

MPEP §2141.01 III indicates that the content of the prior art is determined at the time the invention was made to avoid hindsight. MPEP §2141.02 directs that the prior art must be considered in its entirety, including disclosures that teach away from the claims. MPEP §2143.01 directs that disparate teachings in the prior art must be considered. It states:

> WHERE THE TEACHINGS OF THE PRIOR ART CONFLICT, THE EXAMINER MUST WEIGH THE SUGGESTIVE POWER OF EACH REFERENCE
>
> The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art, and all teachings in the prior art must be considered to the extent that they are in analogous arts. Where the teachings of two or more prior art references conflict, the examiner must weigh the power of each reference to suggest solutions to one of ordinary skill in the art, considering the degree to which one reference might accurately discredit

> another. In re Young, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991) (Prior art patent to Carlisle disclosed controlling and minimizing bubble oscillation for chemical explosives used in marine seismic exploration by spacing seismic sources close enough to allow the bubbles to intersect before reaching their maximum radius so the secondary pressure pulse was reduced. An article published several years later by Knudsen opined that the Carlisle technique does not yield appreciable improvement in bubble oscillation suppression. However, the article did not test the Carlisle technique under comparable conditions because Knudsen did not use Carlisle's spacing or seismic source. Furthermore, where the Knudsen model most closely approximated the patent technique there was a 30% reduction of the secondary pressure pulse. On these facts, the court found that the Knudsen article would not have deterred one of ordinary skill in the art from using the Carlisle patent teachings.).

Appellants submit that Nagaraj et al. teaches a textured surface to improve the adhesion of the ceramic top coat repair to the exposed bond coat. This textured surface, including any grooves included therein, is random in nature, as the techniques utilized to apply the textured surface provide a random texture, such as chemical etching, grit blasting and water jet. See col. 4, lines 48-50 and col. 5, lines 16-20 and Figs. 2 and 3. While techniques discussed in Nagaraj et al. are capable of producing patterned surface finishes, they also can produce non-random finishes. However, random finishes are taught by Nagaraj et al., as indicated by the requirement for an average surface roughness of at least about 300 micrometers, see column 5, line 14. The teaching of a surface finish with a predetermined pattern is lacking. Thus the smoothest surface finish acceptable by Nagaraj et al. is 300 micrometers, rougher surface finishes being acceptable. Skelly et al. teaches away from the use of the techniques advocated by Nagaraj et al. Skelly at col. 7, lines 55-60, indicates that one of its important advantages is its preselected, controllable pattern of features. Processes such as grit blasting and chemical etching cannot produce such controllable patterns. Skelly et al. at col. 3, lines 22-26 teaches that a high degree of surface roughness such as taught by Nagaraj et al. improves the adherence of ceramic coating to the interfacial layer. Appellants note that Nagaraj et al. advanced the art by applying this knowledge to repair localized areas, whereas repair of damaged areas previously required stripping the coating system from the substrate. Skelly et al., however, is directed to applying a predetermined geometric pattern to the entire surface of new-make articles to increase their life expectancy by delaying the onset of spallation.

Appellants submit that the teachings of Skelly et al. and Nagaraj et al. conflict so that the combination of the two, when considered as a whole, would not be made by one skilled in the art.

D. Whether the Combination of Nagaraj et al and Skelly et al. Based on Hindsight Reasoning by the Examiner.

Nagaraj et al. and Skelly et al. have been discussed in above and the summary of these references will not be repeated here. The combination of the two references provides all of the elements claimed by Appellants for localized repair of ceramic coating spalled from a bond coat. (Appellants note that the combination set forth by the Examiner does not address the repair of a substrate from which the bond coat has been removed, as set forth in claims 15-20). However, as noted above, there is no motivation to combine the references. In fact, the teachings of the references teach away from each other so that one skilled in the art would not be motivated to make the combination. Of course, the Examiner's reasoning to combine the references despite the lack of motivation to make the combination, and indeed, in the presence of contrary teachings, suggests impermissible hindsight, as well as "obvious to try" rationale. Although the combination yields all of the claim elements of several of the claims, this still constitutes impermissible hindsight reasoning in the absence of a motivation to combine the references, particularly in view of the presence of teachings in the references that appear to conflict with one another. The references must be viewed without the benefit of hindsight afforded by the claimed invention. *See Hodosh v. Block Drug Co., Inc.*, 786 F.2d. 1136, 1143 at n.5, 229 USPQ 182, 187 at n.5 (Fed. Cir. 1986). It is well established that "obviousness cannot be found by hindsight combination to produce the claimed invention. It is the prior art itself, and not the applicant's achievement, that must establish the obviousness of the combination." *See In re Dance*, 48 USPQ2d 1635 (Fed. Cir. 1998). Here, Nagaraj et al. is silent with respect to the establishment of anything but localized, random textured patterns on bond coats in order for application of ceramic materials to these localized areas where spalling has occurred. Skelly et al. recognizes the importance of preselected geometric patterns on new-make blades and teaches the application of such patterns as part of the entire thermal barrier system to promote increased life by delaying the onset of spallation, and includes no suggestion as to how to adapt this system to repair of damaged components. Appellants submit that the Examiner arrives at her analysis

for combination of Nagaraj et al. with Skelly et al. to achieve certain claims of the Appellants' invention only after exposure to the ideas and teachings set forth by Appellants. Thus, claims 2-26 are not rendered obvious by the proposed combination.

SUMMARY

In summary, Appellants claim a method for accomplishing localized repair of the thermal barrier system a turbine component from which ceramic top coat or ceramic top coat and bond coat have spalled or otherwise been removed. The method includes texturing the exposed surface with a high energy beam to produce an array of spaced grooves having predetermined spacing, groove geometry and wall angle prior to depositing the replacement thermal barrier coating in the localized area.

The cited art, the Nagaraj and Skelly references provide the claim elements claimed by applicants in claims 2-14 and 21-26. However, the Nagaraj reference is deficient in that it does not teach an array of spaced grooves having predetermined spacing, groove geometry and wall angle prior to depositing the replacement thermal barrier coating in the localized area. It teaches the presence of a textured surface by techniques that produce random texture finishes with a preselected surface roughness. The Skelly reference adds the predetermined spacing, groove geometry and wall angle, but is directed at these features as part of the overall thermal barrier system applied to new make articles to delay the onset of failure by spallation. It does not disclose repair of localized spallation damage using its predetermined geometric patterns. Additionally, the Skelly reference, in achieving its preselected geometry, spacing and wall angles teaches away from the methods taught by the Nagaraj reference to achieve its textured surface. Appellants respectfully submit that the combination of references used by the Examiner to reject Appellants' claims is improper and only achieved by improper hindsight reasoning. Appellants further submit that this combination does not yield Appellants' invention as claimed.

When the claims are viewed against the cited references as a whole, Appellants' claims are not obvious. The Examiner arrives at this combination as a result of impermissible hindsight. Even, if proper, the combination does not yield Appellants' invention. Accordingly, favorable consideration of this appeal is respectfully requested. Accordingly, favorable consideration of this appeal is respectfully requested.

Respectfully submitted,

McNees Wallace & Nurick LLC

By Carmen Santa Maria

Dated: April 19, 2004
Appendix – Claims 1-27

Carmen Santa Maria
Reg. No. 33,453
Attorney for Appellants
100 Pine Street
P.O. Box 1166
Harrisburg, PA 17108-1166
Tel.: (717) 237-5226
Fax: (717) 237-5300

CLAIMS

1. A process for localized repair of a turbine component having a surface with a damaged thermal barrier coating system comprising the steps of:

cleaning a spalled region of the exposed surface of the component;

texturing the exposed surface to produce a textured surface having an array of spaced grooves of predetermined groove spacing, predetermined groove geometry, and predetermined wall angle with the exposed surface; and

depositing a replacement thermal barrier coating over substantially only the textured surface.

2. The process of claim 1 wherein the step of texturing the exposed surface includes impinging a high energy beam on the exposed surface to produce the array of spaced grooves of predetermined groove spacing, predetermined groove geometry and predetermined wall angle with the surface.

3. The process of claim 2 wherein the step of texturing the exposed surface with a high energy beam includes impinging an electron beam on the exposed surface.

4. The process of claim 2 wherein the step of texturing the exposed surface with a high energy beam includes impinging a laser beam on the exposed surface.

5. The process of claim 4 wherein the step of texturing the exposed surface by impinging a laser beam further includes impinging a laser selected from the group consisting of YAG lasers, excimer lasers, diode lasers and YAG-harmonic wavelength lasers.

6. The process of claim 5 wherein the step of texturing the exposed surface by impinging a laser beam further includes impinging a laser beam having a power level of up to 1 KW.

7. The process of claim 6 wherein the step of texturing the exposed surface by impinging a laser beam from an excimer laser further includes impinging the beam at a power level of between about 25 to 40 watts and at a beam traverse speed of about 2 inches per minute to about 15 inches per minute.

8. The process of claim 1 further including the step of blending the deposited thermal barrier coating with adjacent undamaged thermal barrier material to obtain a smooth transition.

9. The process of claim 1 wherein the step of cleaning further includes selecting a cleaning method from the group consisting of grit blasting, vapor degreasing, alkaline cleaning and vapor honing.

10. The process of claim 1 wherein the groove spacing is from about 1 mil to about 8 mil.

11. The process of claim 1 wherein the groove geometry includes unidirectional grooves.

12. The process of claim 1 wherein the groove geometry includes at least two sets of grooves, the grooves within each set being substantially parallel with one another, and the grooves of each set intersecting the grooves of another set of grooves an angle in the range of about 15° to about 90°.

13. The process of claim 1 wherein the groove geometry includes a groove depth that does not exceed the thickness of the deposited ceramic material.

14. The process of claim 2 wherein an incidence angle of the high energy beam with the surface is between about 0° and 75° relative to a plane normal to the surface to produce grooves having predetermined wall angles of between about 15° and 90° with the surface.

15. The process of claim 1 wherein the step of cleaning the exposed surface of the component includes cleaning an exposed surface substrate.

16. The process of claim 15 wherein the step of texturing the exposed surface of the component includes texturing the exposed surface substrate.

17. The process of claim 15 wherein the step of depositing a replacement thermal barrier coating over substantially only the textured substrate further includes first depositing a bond coat over the textured substrate without concealing the texturing, the followed by depositing a ceramic layer over the bond coat.

18. The process of claim 15 further including the additional step of depositing a bond coat over the exposed surface substrate.

19. The process of claim 18 wherein the step of texturing includes texturing the deposited bond coat.

20. The process of claim 18 wherein the step of depositing a replacement thermal barrier coating over substantially only the textured bond coat.

21. The process of claim 1 wherein the step of cleaning the exposed surface of the component includes cleaning an exposed bond coat layer.

22. The process of claim 21 wherein the step of texturing the exposed surface of the component includes texturing the exposed bond coat layer.

23. The process of claim 22 wherein the step of depositing a replacement thermal barrier coating over substantially only the textured substrate further includes depositing a ceramic layer over the bond coat.

24. A process for localized repair of a turbine component having a surface with localized damage to thermal barrier coating system in which the ceramic top coat has spalled, exposing an underlying bond coat, comprising the steps of:

cleaning the exposed bond coat;

machining the exposed bond coat using a high energy beam to produce a substantially linear array of substantially equally spaced grooves intersecting at an angle of between about 15° to about 90° and spaced about 1mil to about 5 mil, the grooves being no deeper than the thickness of the bond coat and formed by a high energy beam incident at an angle of about 0° to about 75° normal to the surface of the bond coat; and

depositing the ceramic material on the machined bond coat.

25. The process of claim 24 further including the additional step of masking the surfaces of the component adjacent to the exposed bond coat.

26. The process of claim 24 further including the additional step of blending the deposited ceramic material with the adjacent surfaces of the component following repair to maintain surface uniformity and smoothness.

27. A turbine component having a surface with a thermal barrier coating system with a localized repair made by the process of claim 1.